

BOTANY.—*Linanthastrum*, a new West American genus of Polemoniaceae.¹

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The perennial montane genus *Linanthastrum* as here established represents a small series of Polemoniaceae of conceivably greater antiquity from the phylogenetic standpoint than the related annual genus *Linanthus*. The present distribution of the genus *Linanthastrum* constitutes what may well be a relict pattern of boreal origin, occupying as it does old mountain masses and tablelands of western North America. This genus is most closely related morphologically to *Linanthus*, but its more northern and montane-to-subalpine distribution suggests a different origin from that genus of more Sonoran tendencies, if one may borrow vegetation-terms from two different schools of ecologists. Furthermore, *Linanthastrum* differs from *Linanthus* in that the calyces are not scarious below the sinuses (cf. Fig. 2)—a character of reliable constancy in the rather natural genus *Linanthus*, when the present perennial

group is removed from it. *Leptodactylon* is its nearest morphological ally on the other side; from this genus *Linanthastrum* differs in having scarcely or not at all pungent, closely opposite, falsely whorled leaves, and very dissimilar calyx. Though *Linanthastrum* occupies about the same geographic region and ecologic niche as *Leptodactylon*, it is not so strongly xerophytic as that genus. A phylogeny of the Polemoniaceae has recently been suggested² in which *Linanthus* is a derivative from *Leptodactylon*, the two genera constituting an evolutionary line distinct from the true *Gilias*, *Langloisia*, *Ipomopsis*, and *Hugelia*. Wherry's phylogeny needs to be modified but slightly to include *Linanthastrum*, in what the author believes to be a natural relationship:

¹ Received October 28, 1941.

² WHERRY, EDGAR T. *A provisional Key to the Polemoniaceae*. *Bartonia* 20: 17. 1940.

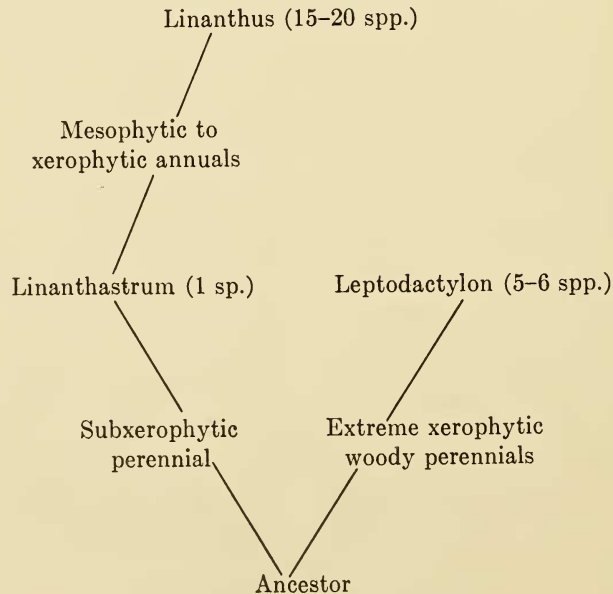


Fig. 1.—A putative phylogeny for three genera of Polemoniaceae: *Leptodactylon*, *Linanthastrum*, and *Linanthus*; in all these the chromosome number $n = 9$.

HISTORICAL NOTE

Thomas Nuttall first recognized the present genus *Linanthastrum* in essentially the sense here defined, naming it *Siphonella*. This was never published by him, but Asa Gray cited the binomial *Siphonella montana* when publishing *Gilia nuttallii* (1870). By his choice of specific name Gray evidently

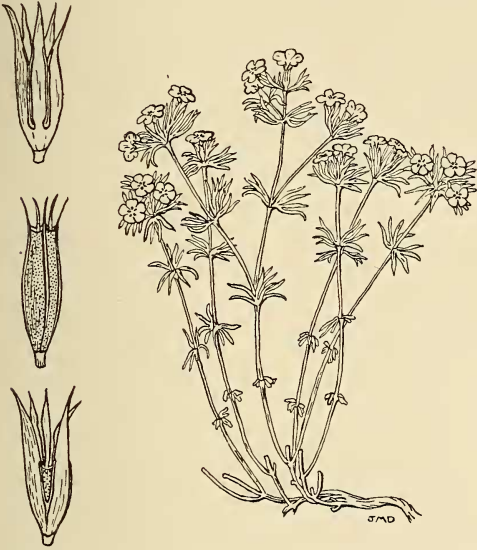


Fig. 2.—*Linanthastrum nuttallii* (Gray) Ewan: Habit sketch from Payson & Armstrong 3458, Wyoming, $\times \frac{1}{2}$. Calyces: Upper, *Linanthastrum nuttallii*; middle, *Leptodactylon pungens* (Torr.) Nutt.; lower, *Linanthus androsaceus* (Benth.) Greene. Intercostal membranes stippled.

wished to record his recognition of Nuttall's part in the characterization of the species. Gray did not designate a type in his original description, for he did not practice the "type basis concept" of the present day. However, Nuttall's contribution toward establishing the concept of *Gilia nuttallii* must be borne in mind when fixing the type of that species. When describing the species Gray placed it in a section *Siphonella*—taking up Nuttall's manuscript generic name—which he considered to be related to the section *Leptodactylon*. (Dalla Torre and Harms (1907) erroneously date the establishment of the section *Siphonella* from the Botany of California (1880) rather than 1870.) Up to 1904, then, our plant was treated as a species of *Gilia*. But in that year Greene's manuscript herbarium name

Linanthus nuttallii was published.³ Milliken did not accept *Leptodactylon* as a genus of the Californian flora, and no comment was made by her as to the anomalous nature of *Linanthus nuttallii* within the genus *Linanthus*. When Rydberg in 1906 resurrected *Leptodactylon* as a genus he included *Gilia nuttallii* therein. (Though proposed by Hooker and Arnott in 1841, Bentham placed *Leptodactylon* in the genus *Gilia* as a section in 1845, and was widely followed.) After Rydberg, *Linanthastrum* was considered a member of the genus *Gilia* by Brand (1907), of *Leptodactylon* by Jepson (1925), and of *Linanthus* by both MacMinn (1939) and Wherry (1940). From this summary of the taxonomic history of *Linanthastrum* it is clear that we are dealing with an anomalous group, fitting poorly into our present alignment of the gilioid genera.

| *Linanthastrum*, genus novum

Siphonella Nutt. ex Gray, Proc. Amer. Acad. 8: 267. 1870, as a synonym.

Herba perennis caulis e basi lignescens suffrutescens plurimus simpliciusculis erectis subscopariis; foliis 3-7 partitis, laciniis acicularibus non pungentibus brevo-mucronatis integerrimis enervosis; floribus subspeciosis in acillaribus superioribus, calycium tubis campanulatis brevibus sinibus inter dentes non scarioso-membranaceis; staminibus sub fauce insertis filamentibus glabris.

Tufted puberulent perennials with rather virgate simple stems, the upper internodes mostly shorter than the leaves; leaves appearing as if whorled, the blades 3-7 parted, the segments linear to acicular, entire, the midnerves obscure. Flowers borne in the upper axils, scarcely exserted from the tufted leaves but somewhat showy. Calyx campanulate, the tube short, not scarious-membranous below the sinuses between the subulate teeth. Corolla-tube funnelform, pale yellow, the lobes 5, obovate, rounded, cream to white or very pale blue. Stamens inserted just below the throat, the filaments glabrous. Pistil included, nearly equalling the tube. Seeds 2-4 in each locule. Fig. 2.

Type species: *Linanthastrum nuttallii* (Gray) Ewan.

Linanthastrum nuttallii (Gray) comb. nov.

Based on *Gilia Nuttallii* Gray, Proc. Am. Acad. 8: 267. 1870, in turn based on Nuttall coll. from "R[ocky] Mts. Bear R[iver] hills" in

³ MILLIKEN, JESSIE. A review of Californian Polemoniaceae. Univ. Calif. Publ. Bot. 2: 54. 1904.

Acad. Nat. Sci. Philadelphia and in Gray Herbarium a fragment labeled as from "Hb. Ac. Phil." According to the map of Nuttall's travels given by Pennell⁴ the type locality would be in the region of Caribou and Bannock Counties, Idaho. There might be some justification for selecting one of the several collections cited by Gray in the original description as the type, but the present author construes these to be paratypes and has so treated them beyond. Gray's choice of specific name seems to me to denote his intentions clearly.

Paratypes: *Fremont*, without loc.; *Anderson*, from near Carson City, Nev.; *Brewer 2042*, Silver Mountain, Sierra Nevada, Calif. (cf. Jepson, *Madrono* 2: 85. 1933, on this mining town); and *Watson 907*, "E. Humboldt Mts.," Nev., which are the present Ruby Mountains, central Elko County (cf. Linsdale, *Pacific Coast Avifauna* 23: 16. 1936). Gray has noted on sheet of *Brewer 2042*, "Filaments unusually long" and "between *S. montana* and *S. parviflora*." This would indicate that he regarded this collection as somewhat exceptional, as C. A. Weatherly has suggested to the author. However, Wherry (in litt.) considers that these paratypes are "all conspecific, but may represent ecological forms of one another."

Linanthus Nuttallii (Gray) Greene ex Milliken, *Univ. California Publ. Bot.* 2: 54. 1904.

Leptodactylon Nuttallii (Gray) Rydb., *Bull. Torr. Club.* 33: 149. Mar. 1906; practically simultaneously published in *Colorado Agr. Expt. Stat. Bull., Flora of Colorado*, 100: 279. Introduction dated March, 1906, but apparently not issued until later that year.

Gilia Nuttallii var. *montana* (Nutt.) Brand in Engler, *Pflzr.* IV. 250: 125. 1907, based on *Siphonella montana* Nutt. ex Gray. Epithet used by Brand to designate the typical phase of the species.

Gilia Nuttallii var. *parviflora* (Nutt.) Brand, *loc. cit.*, based on *Siphonella parviflora* Nutt. ex Gray, l.c., as synonym, and in turn based on Nuttall coll. from "Bear R. hills" acc. fragments at both Gray Herb. (ex Brit. Mus. Nat. Hist.) and Acad. Nat. Sci. Philadelphia. Wherry (in litt.) states that the differences between this collection and that of *S. montana* are "so slight that it is strange that Nuttall named them differently. His "*Siphonella montana*" has the leaves essentially glabrous, his "*S. parviflora*" has them more or less pilose. I can not see any difference in the size of the flowers which would have suggested the name *parviflora*."

Illustrations: *Watson*, *Botany Fortieth Parallel*, pl. 25, fig. 8, 1871, presumably based on *Watson 907* from Nevada, a paratype, is good. *MacMinn*, *Illus. Man. California Shrubs*, fig. 532, 1939, presumably drawn from either a

Sierran (e.g., Lake Tahoe) or Cascadean specimen, but not indicated.

Rather bushy perennial from a woody branching suffrutescent crown, the stems several, simple, 15–20 cm tall, puberulent, straw-colored; leaf segments 3–7, flat, 1.0–1.5 cm long, strictly linear or actually less than 1 mm broad, glabrous or glabrate, sparingly ciliate, the leaves overlapping due to the relative shortness of the internodes especially in the upper parts (except in plants of southernmost portions of its range), thus forming chara-like tufts near the tips of the stems, those in the lower half soon withering; calyx 8–10 mm long, the tube 2 mm long, the teeth lance-subulate, shortly acute, puberulous; corolla-tube yellow, 8–9 mm long, glabrous within, pubescent with curling hairs without, the lobes 4–5 mm long, white or pale, somewhat chalky, blue; capsule narrowly obovoid, 5 mm long, smooth.

Subalpine meadow borders or less often among rock outcrops and about the margins of scree slopes, always in well-drained, often granitic soils. Washington and northern Idaho south along the Cascades and Sierra Nevada to southern California, the mountains of northern Nevada and Utah, and south along the Rocky Mountains to central Colorado. A taller more slender form differing in greater pubescence occurs in New Mexico, northern Arizona, and (?) in Baja California.

Representative collections (at Univ. Colorado unless indicated): WASHINGTON: Lewis County: Eagle Peak, 5,600 ft., Tatoosh Range, *Ewan 10601*; Goat Mts., *Allen 119* (ANSP)⁵. Kittitas County: Mts. n. Ellensburg (Piper, Fl. Wash. 462). Columbia County: Blue Mts. (Piper, l.c.). IDAHO: Ridge s. Pole Mt., 5,000 ft., *Epling et Kempf s. n.* Valley County: Gold Fork lookout, Sawtooth Mts., 8,000 ft., *J. W. Thompson 13763*. Custer County: Robinson Bar, 25 VI 1931 *Wherry* (Univ. Pa. Herb.). OREGON: Wallowa County: Wallowa Mts., *Ownbey 1843* (Univ. Pa. Herb.). Crook County: *Peck 9637* (ANSP). Harney County: Steins Mt., 8,000–9,000 ft., 1 VII (no year) *Percy Train*. UTAH: Salt Lake County: *Garrett 1559a* (ANSP). CALIFORNIA: Humboldt County: 28 mi. se. Orick, *S. W. Hutchinson 4152*. Modoc County: Little Lily Lake, Pine Creek, Warner Mts., *Wheeler 3789* (ANSP). Mono County: Mammoth Lakes P.O., *Constance 2423* (ANSP); Leevining Canyon, *Benson 3767* (ANSP); Inyo Mts. (Coville, Death Valley Rept. 156). Inyo County: Bishop, 1928, *S. W. Hutchinson s. n.* Wyman Creek, White Mts., *Duran 3048* (Univ. Pa. Herb.). Tulare County: Farewell Gap, *Culbertson 4536* (ANSP); Mt. Whitney (Brand, *op. cit.*). San Bernardino County: Foxeese Creek, *Parish 3686* (ANSP). Riverside County: El Toro, Santa Rosa Mts. (Milli-

⁴ PENNELL, FRANCIS W. *Travels . . . of Thomas Nuttall*. *Bartonia* 18: pl. 3. 1936.

⁵ Abbreviation for Academy of Natural Sciences of Philadelphia.

ken, *op. cit.*). NEVADA: Douglas County: Zephyr Point, 6,300 ft., Lake Tahoe, *Mason 12161*, Elko County: East Humboldt Mts. (i.e., Ruby Mts.), *Watson 907* (ANSP). WYOMING: Lincoln County: Sheep Mt., Snake R. Range, *Payson et Armstrong 3458*. Sublette County: Gros Ventre Mts., *E. B. et L. B. Payson 3028*. COLORADO: ?Lake County: s. slope Fremont Pass, *A. et R. Nelson 145*. Eagle County: w. slope Tennessee Pass, 10,400 ft., *Schmoll 1545*; Oro City, 10,800 ft. (Wheeler Survey Rept. 199). Routt County: Steamboat Sprs., 6,500 ft., VII 1891, *Eastwood*. Jackson County: (formerly part of Larimer County.) Rabbit Ears, *Goodding 1540*. Gunnison County: Ragged Mt., 11,700 ft., (Rydberg, Fl. Colo.). Mineral County: Near Pagosa Peak, San Juan Range (Rydberg, l.c.); 10 mi. e. Wolf Creek Pass on Continental Divide, 12,000 ft., *Penland 1154* (Colo. Coll. Herb.). Custer County: Venable Lake, Sangre de Cristo Mts., *M. Marriage et P. Johnson 14 VII 1932* (Colo. Coll. Herb.). Bent County: Robinson, 4,007 ft. (Rydberg, l.c., presumably pls. carried down on flood waters of Arkansas R.).

Linanthes nuttallii* subsp. *floribundum
(Gray) comb. nov.

Based on *Gilia floribunda* Gray, Proc. Amer. Acad. 8: 267. 1870, in turn based on *Coulter 454* "California, probably on se. borders." Likely from vicinity of Warner Hot Springs, San Diego County, where Thomas Coulter is known to have passed. Paratypes: *E. W. Morse* coll., 1866, from 50 mi. s. San Diego, Baja California and *Coues et Palmer* coll., 1865, from "pine woods of Arizona," according to label from Ft. Whipple, 5 VIII 1865, numbered 98 and annotated "fl. white; throat yellow; scent delicate." (For a descriptive account of *Coues's* visit to Fort Whipple see the *Ibis* (ser. 2) 2: 259-275. 1866.)

Linanthes floribundus Greene ex Milliken, Univ. California Publ. Bot. 2: 55. 1904.

G. Nuttallii var. *parviflora* (Nutt.) Brand subvar. *floribunda* (Gray) Brand in *Ergler Pflzr. IV. 250: 125. 1907.*

G. Nuttallii var. *floribunda* (Gray) Munz, Man. S. California Bot. 399. 1935.

Leptodactylon floribundum (Gray) Tidestrom, Proc. Biol. Soc. Washington, 48: 42. 1935.

Linanthes Nuttallii var. *floribundus* (Gray) McMinn, Illus. Man. Calif. Shrubs 446. 1939.

Illustration: MacMinn, *op. cit.* fig. 533.

Plants of more open habit, the stems slender, generally taller, rather wiry, densely clothed with simple subfiliform or few-lobed leaves; flowers hardly crowded or glomerate, the uppermost distinctly pedicellate, the corollas smaller, 10-15 mm long; seeds usually 4 in each locule (always 2 in each locule in the typical subspecies of *L. nuttallii*, *sic* Gray and Brand).

Dry brushy slopes in clearings of the chaparral. New Mexico south to Chihuahua, Mexico, west to Baja and southern California, but apparently local.

Representative collections (as above, at Univ. Colorado unless otherwise indicated): NEW MEXICO: Lincoln County: Tularosa Creek, White Mts., 18 VIII 1899, *Wootton*. Catron County: 15 mi. s. Luna, 6,700 ft. *C. L. Hitchcock et al. 4482*. ARIZONA: Yavapai County: Fort Whipple. MEXICO: Chihuahua: Pachaco, *Hartmann 682* (ANSP); Baja California: paratype cited above. CALIFORNIA: San Diego County: Warner's Reh., 3,165 ft., VI 1927, *S. W. Hutchinson s. n.*; Descanso, 20 VI 1932, *Epling et al.*; Cold Spring, 21 VI 1932, *Epling et al.* Riverside County: Coyote Canyon, *sic* Milliken, *op. cit.*; Elsinore, *ibid.*; San Jacinto (*ibid.*); Santiago Peak, Santa Ana Mts., *Abrams 1809* (ANSP).

In an occasional individual collection *Linanthes nuttallii floribundum* may appear fully distinct from the typical subspecies, but when a series is studied really satisfactory characters for a key can not be found. Though the two have not been found growing together, the more southern subspecies occupies the more xeric habitats at rather distinctly lower elevations. In the Santa Rosa Mountains of southern California the two subspecies approach each other closely; nevertheless, the two may even there show ecologic preferences. It cannot be finally declared that there are not two species in this genus, as held by Asa Gray, Greene and Milliken. The herbage of the typical subspecies is distinctly hay-scented and the flowers of both it and *L. nuttallii floribundum* are delicately fragrant.

SUMMARY

Linanthes is established as a segregate genus of the gilioid complex, most closely related to *Linanthus*, but differing from that rather natural genus in its habit-form, in the calyces not being scarious below the sinuses, in its perennial duration and its more northern, usually upper montane or subalpine, distribution suggestive of a different origin. From *Leptodactylon* it differs in having scarcely or not at all pungent, closely opposite, falsely whorled leaves, as well as in calyx-features. This group of one species with two subspecies is more naturally disposed among the gilioid members of the Polemoniaceae when admitted as a small genus of transitional morphology, sharing as it does certain characters of both *Linanthus* and *Leptodactylon*.